

Science education in Europe

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**Great diversity
(but also common challenges)**

**The diversity provides an
opportunity to learn from
others!**

Session Overview

- ❑ **Svein Sjøberg** Introduction + focus on attitudes and interests in S&T (15 min)
- ❑ **Ilka Parchman** Science teachers and the science curriculum (10 min)
- ❑ **Costas Constantinou** Higher education and preparation for research (10 min)
- ❑ **Edgar Jenkins** ('outsider') Assessment and career advice)(15 min)
- ❑ Discussion and inputs from the audience (app 25 min)

Why Science in (compulsory) schools?

- Main focus is ***not*** on recruitment and preparation for academic studies, but...
- for citizenship, critical thinking, (Bildung!)
Slogans: "Science for all", "scientific literacy"
etc.
- **School science** is essential for perceptions of science, attitudes to science, appreciation, acceptance and respect for S&T
- and ***may***, if properly done, lead to improved recruitment!

Learning from others: Comparative studies

- ❑ Studies like TIMSS and PISA are important, but ...
- ❑ Focus is on **achievement** – *not* on interest, motivation and choice
- ❑ Even very able pupils opt out of SET – in particular girls!
- ❑ Young people do *not* choose SET careers because it is good for the national economy!
- ❑ But make choices based on their own values, motifs, interests and 'self realization'.

Pupils' choices: Key factors

- Pupils' **emotions**:
interests, attitudes, values, future plans, perceptions of SET, prior experience with school science
- Key words:
- **Motivation**
- **Relevance** (personal, social etc.)

Pupils' attitudes to science and technology.

Summary (to be illustrated):

- ❑ **The positive side:**
- ❑ They accept the importance of S&T for **society**
- ❑ S&T will improve life
- ❑ S&T will make work more interesting
- ❑ S&T has more advantages than dangers
- ❑ Young people love modern ICT:
They are great consumers!

Pupils' views, the dark side

- They dislike S&T at school, S&T is difficult and boring etc.
- They are interested in 'real science' – but less in 'school science' (a 'living fossil'?)
- The curriculum is overloaded with 'correct answers' – no room for creativity, fantasy etc.
- They are very hesitant to *study* S&T and to *work* with S&T
- They often have a negative perception of scientists as *persons* (no good role models?)
- Evidence to follow...

ROSE: a cross-cultural comparative project

The voice of the learners



ROSE details at <http://folk.uio.no/sveinsj>

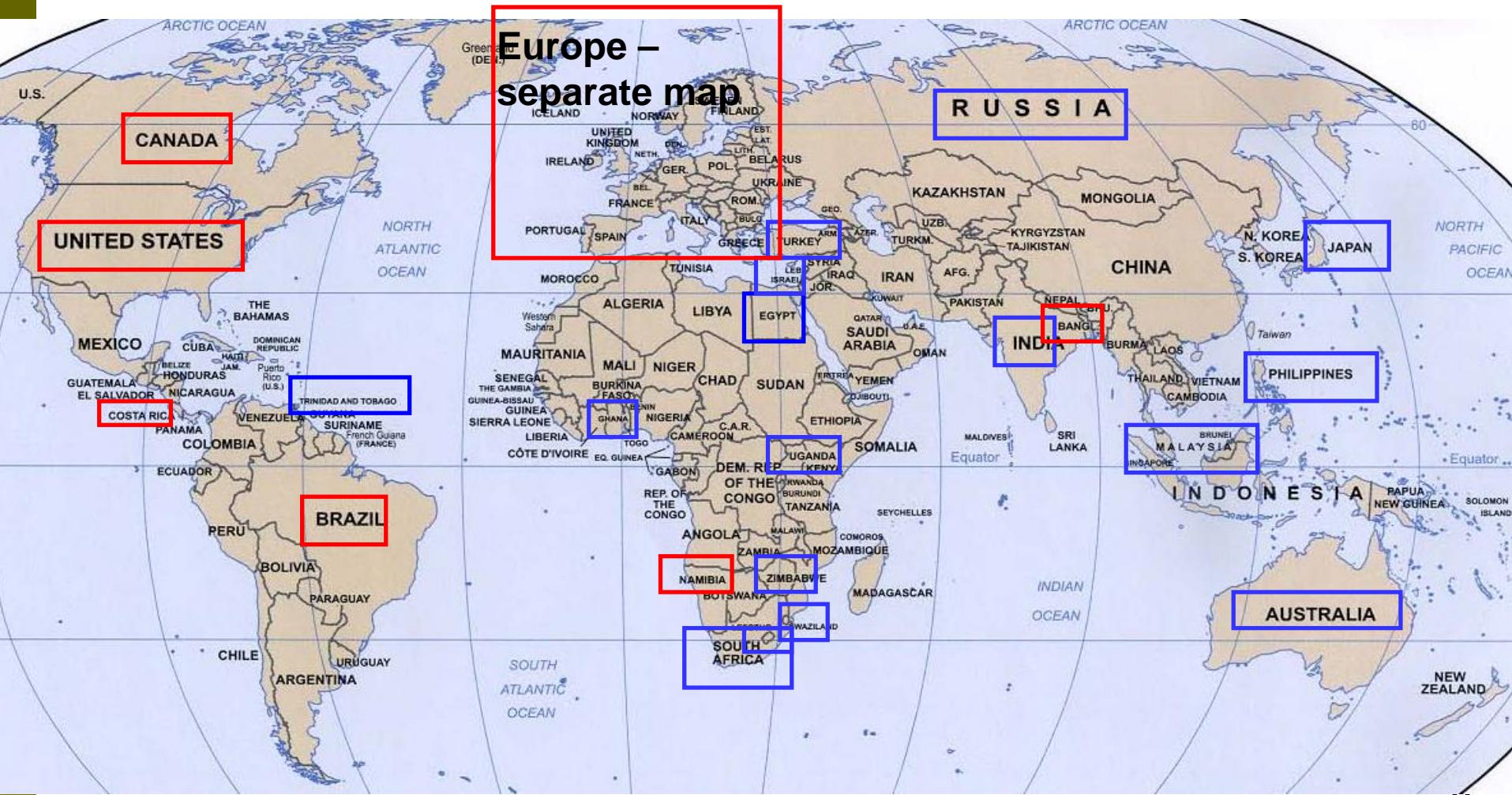


SE

The Relevance of Science Education

Collected data Not finished (or uncertain)

ROSE countries March 2004



ROSE Europe – March 2004

Austria
Denmark
Cyprus
England
Estonia
Finland
Germany

Greece
Iceland
Ireland
Israel
Italy

Latvia
Malta

Northern Ireland

Norway
Poland
Portugal

Russia

Spain (Baleares)

Spain

Sweden

Switzerland

Turkey

Collected data
Not finished (or uncertain)



ROSE Questionnaire: 7 Item groups

In total 250 items, all on a 4-point Likert scale:

Disagree – Agree

Never - Often

My out-of-school experiences

What I want to learn about

My future job

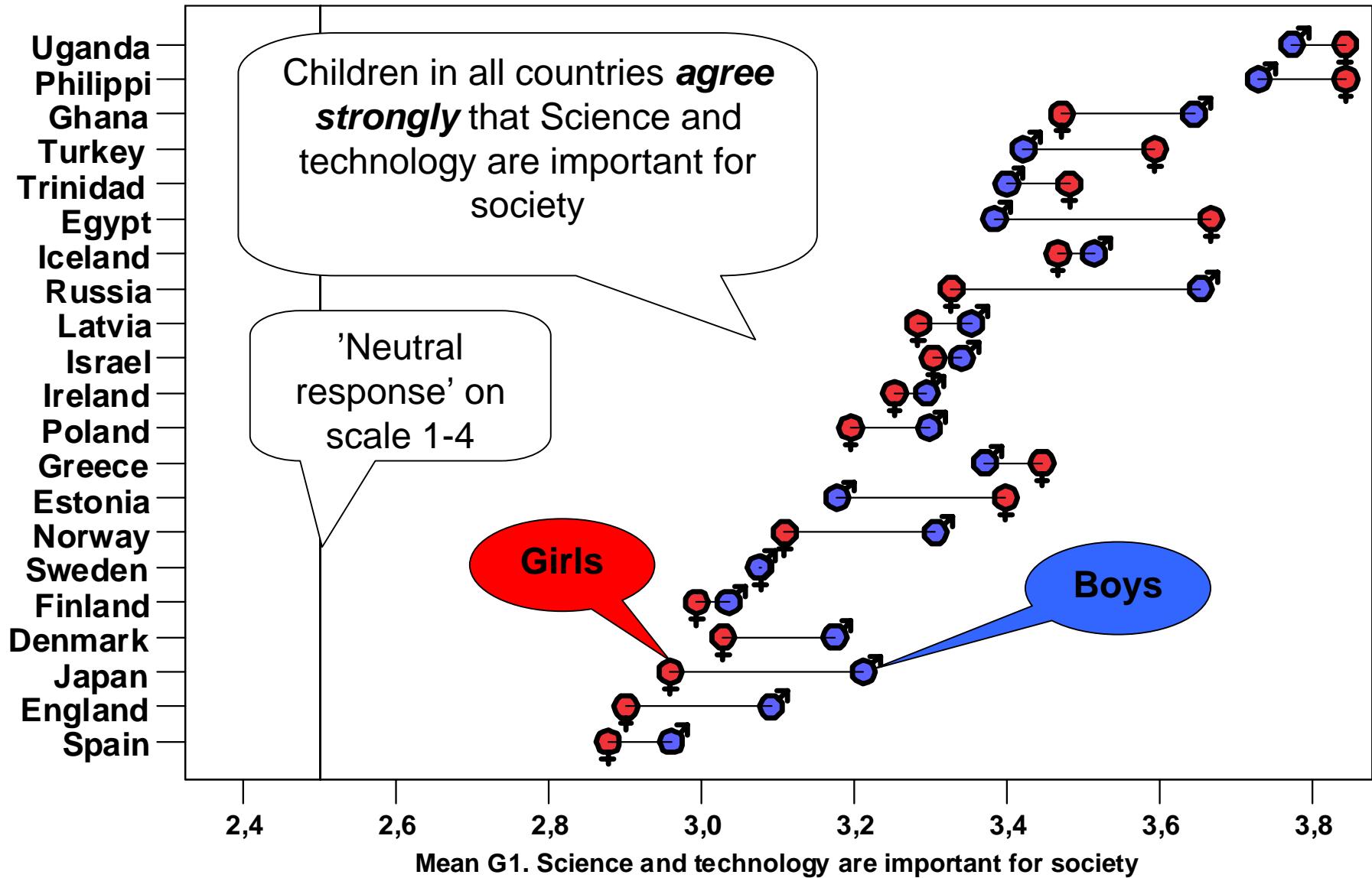
Me and the environment

My science classes

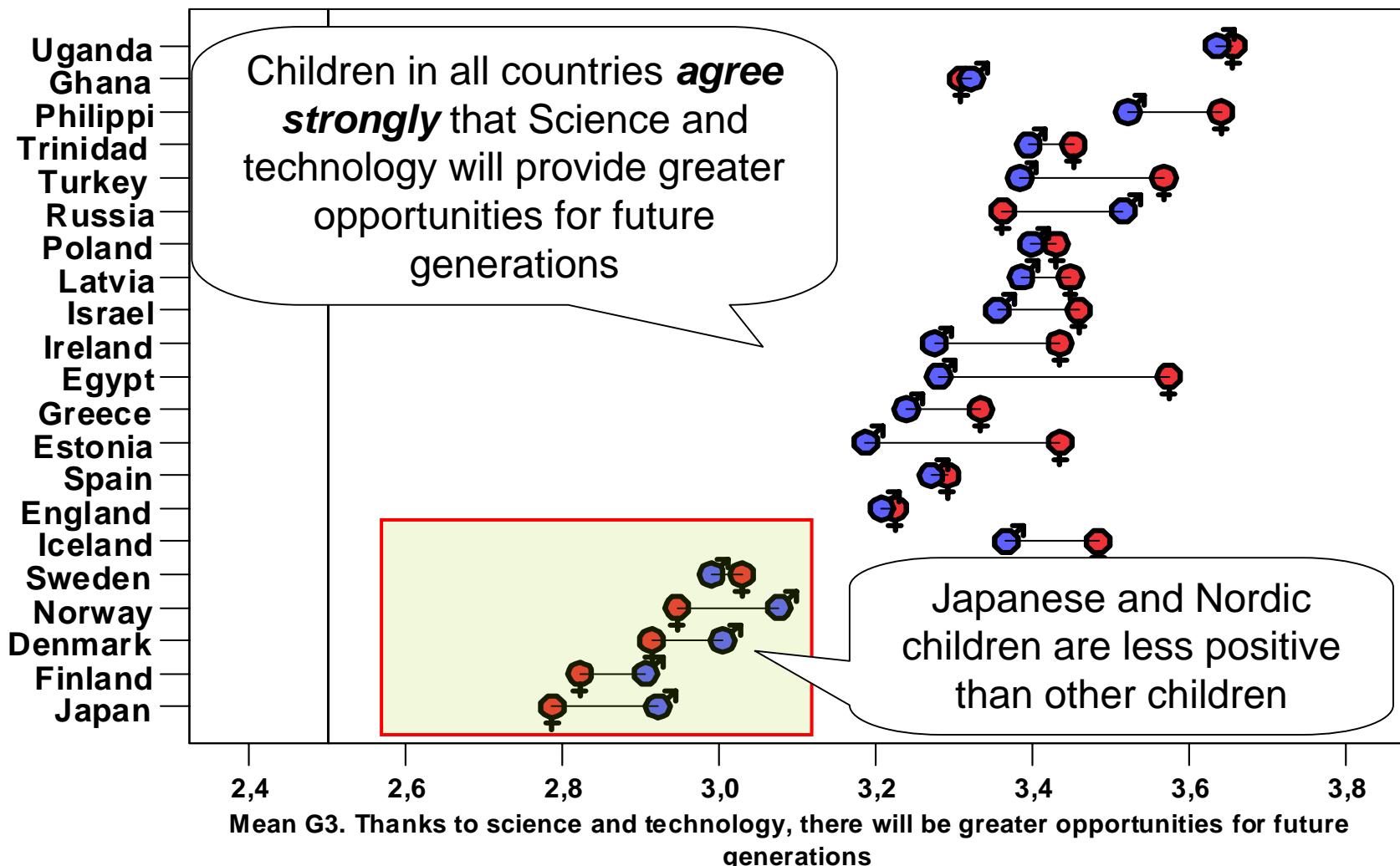
My opinions about science and technology

Myself as a scientist (Open written response)

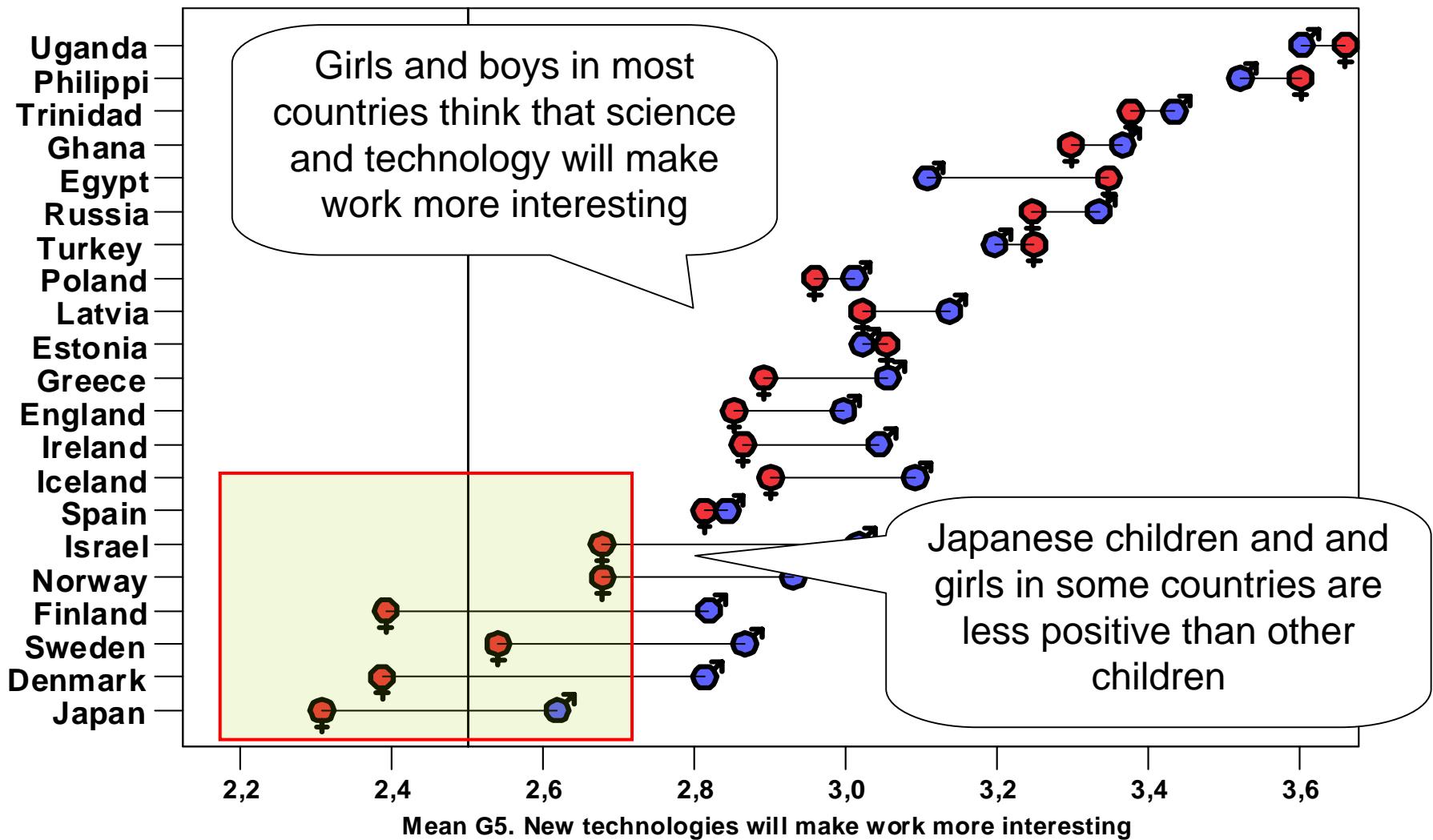
”Science and technology are important for society”



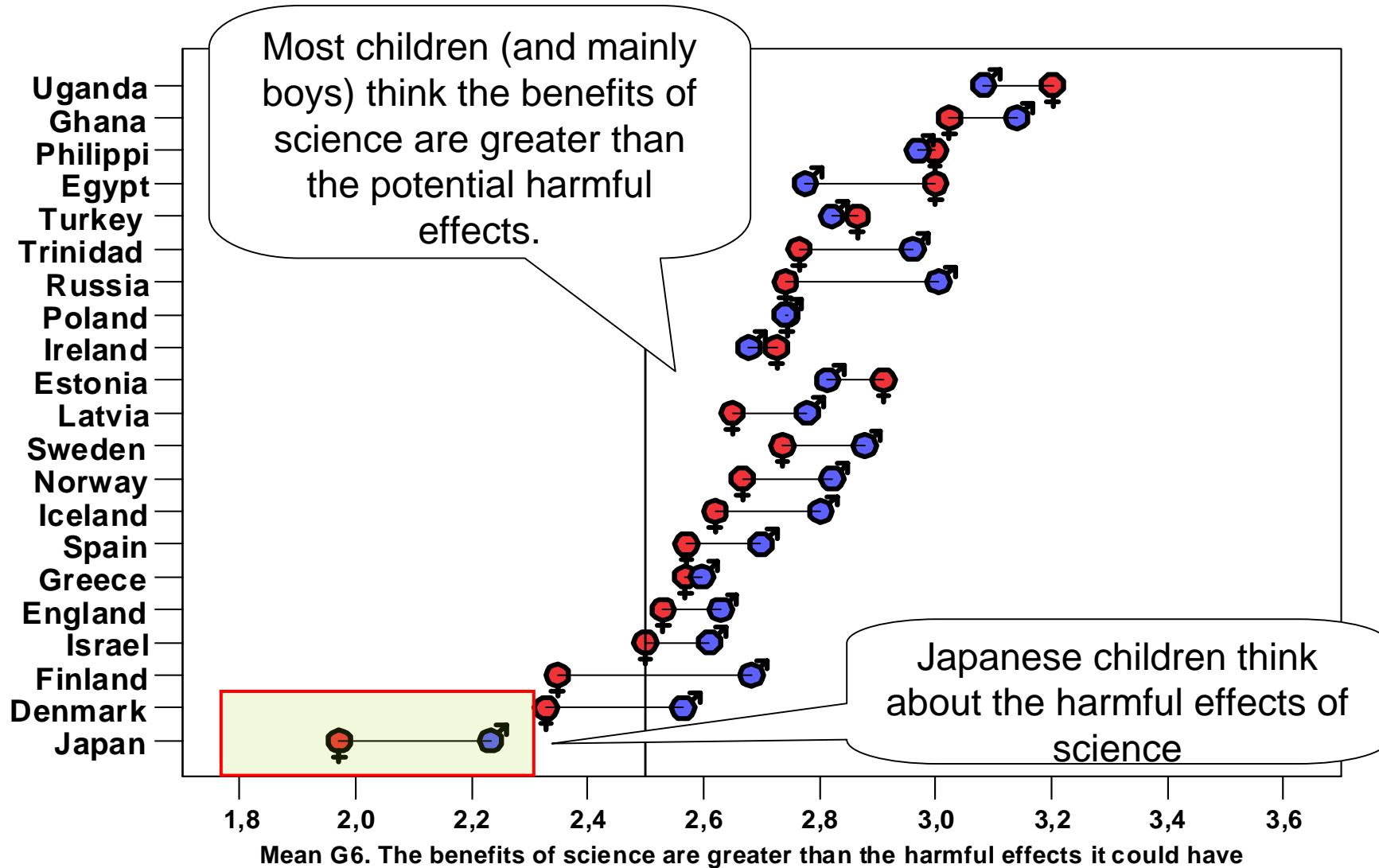
”Thanks to science and technology, there will be greater opportunities for future generation”



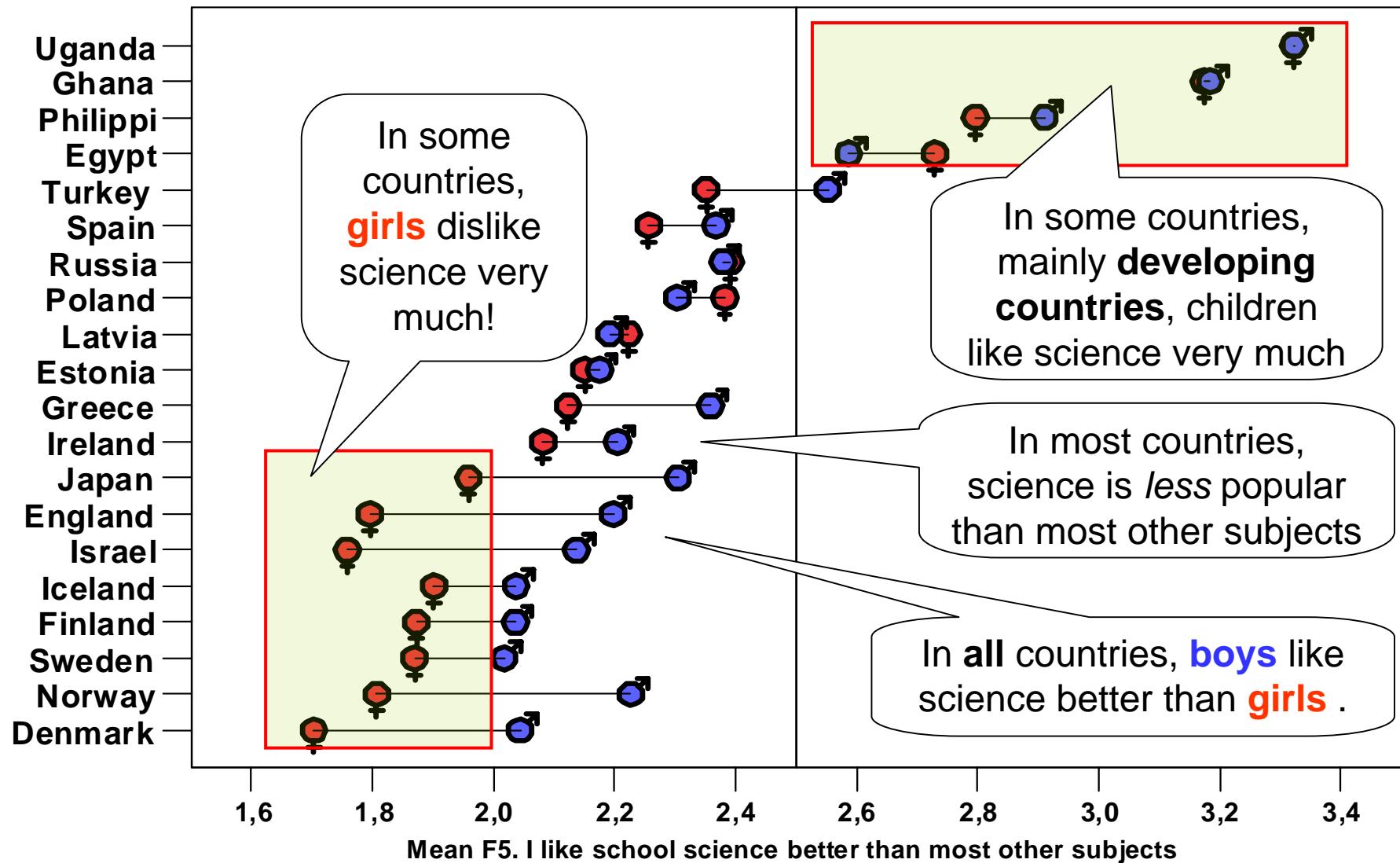
”New technologies will make work more interesting”



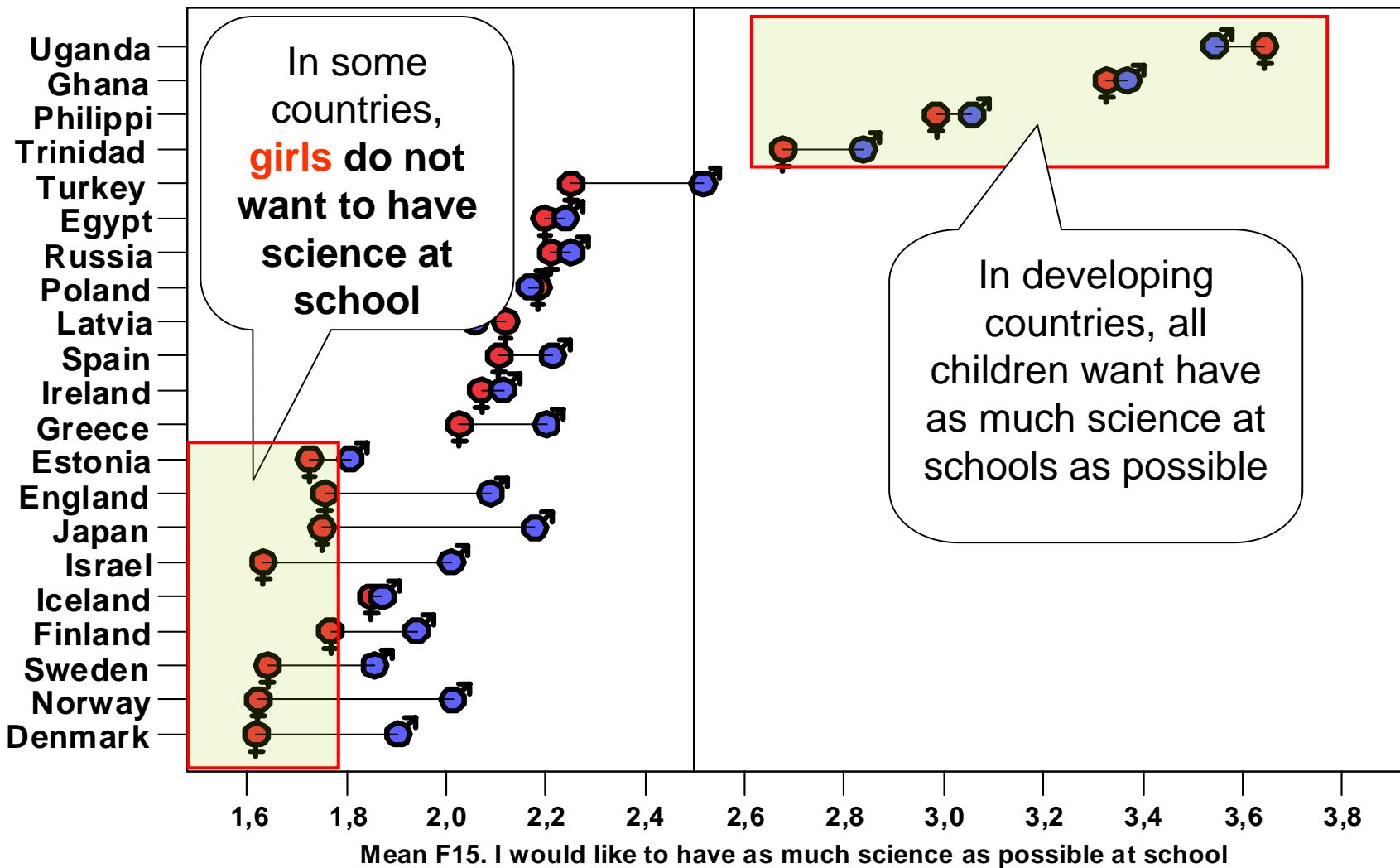
”The benefits of science are greater than the harmful effects it could have”



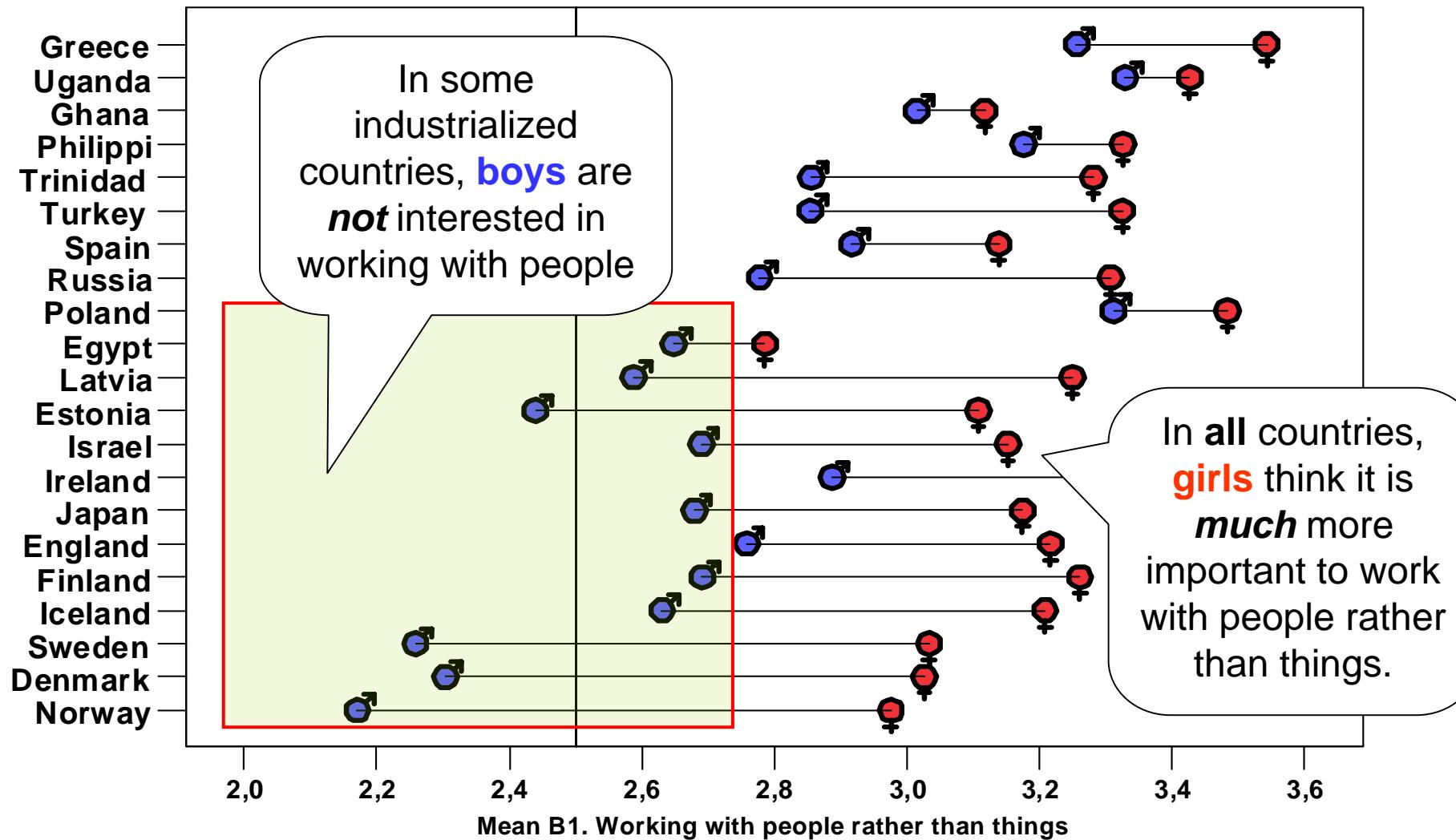
”I like school science better than most other subjects”



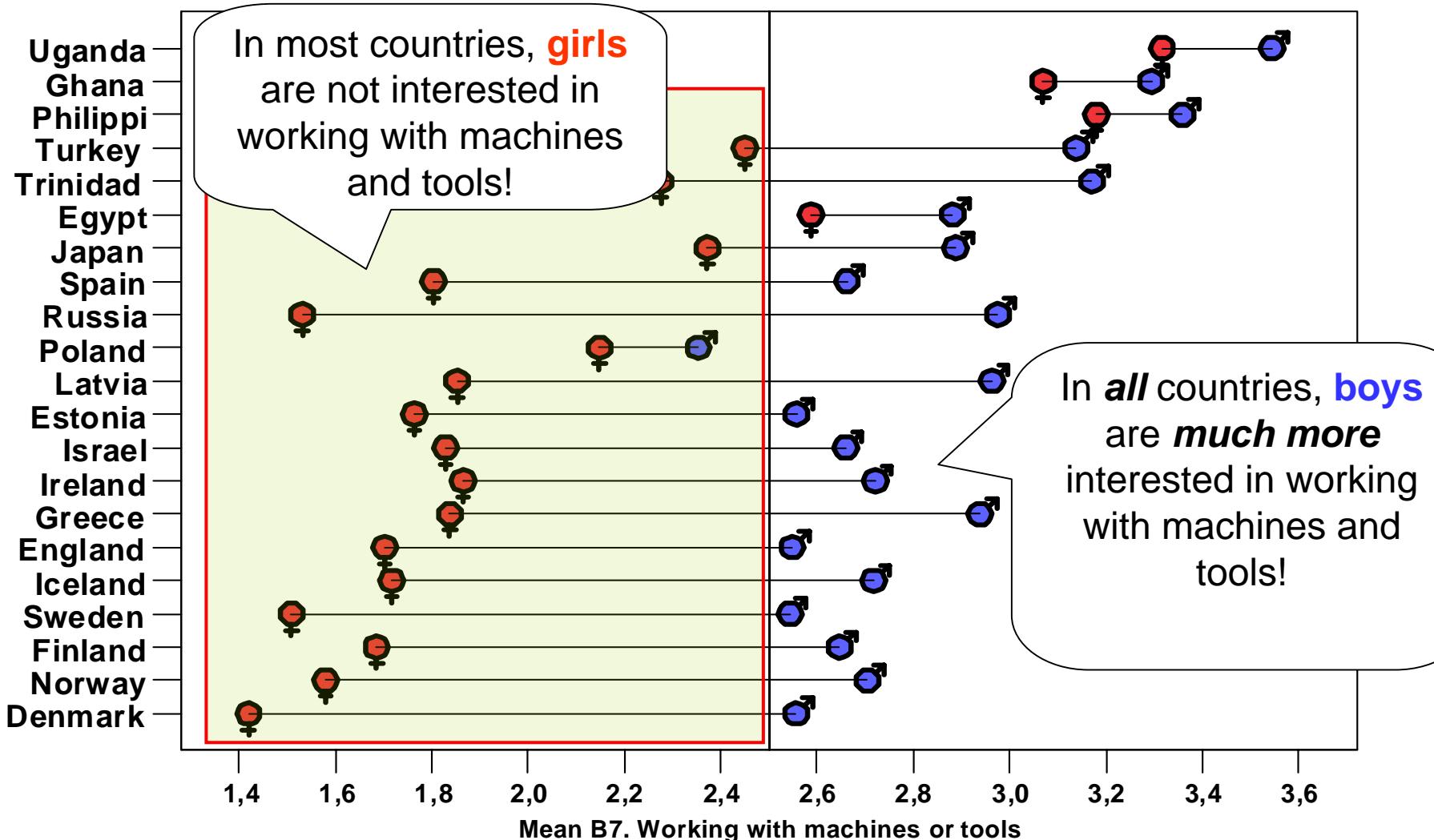
”I would like to have as much science as possible at school”



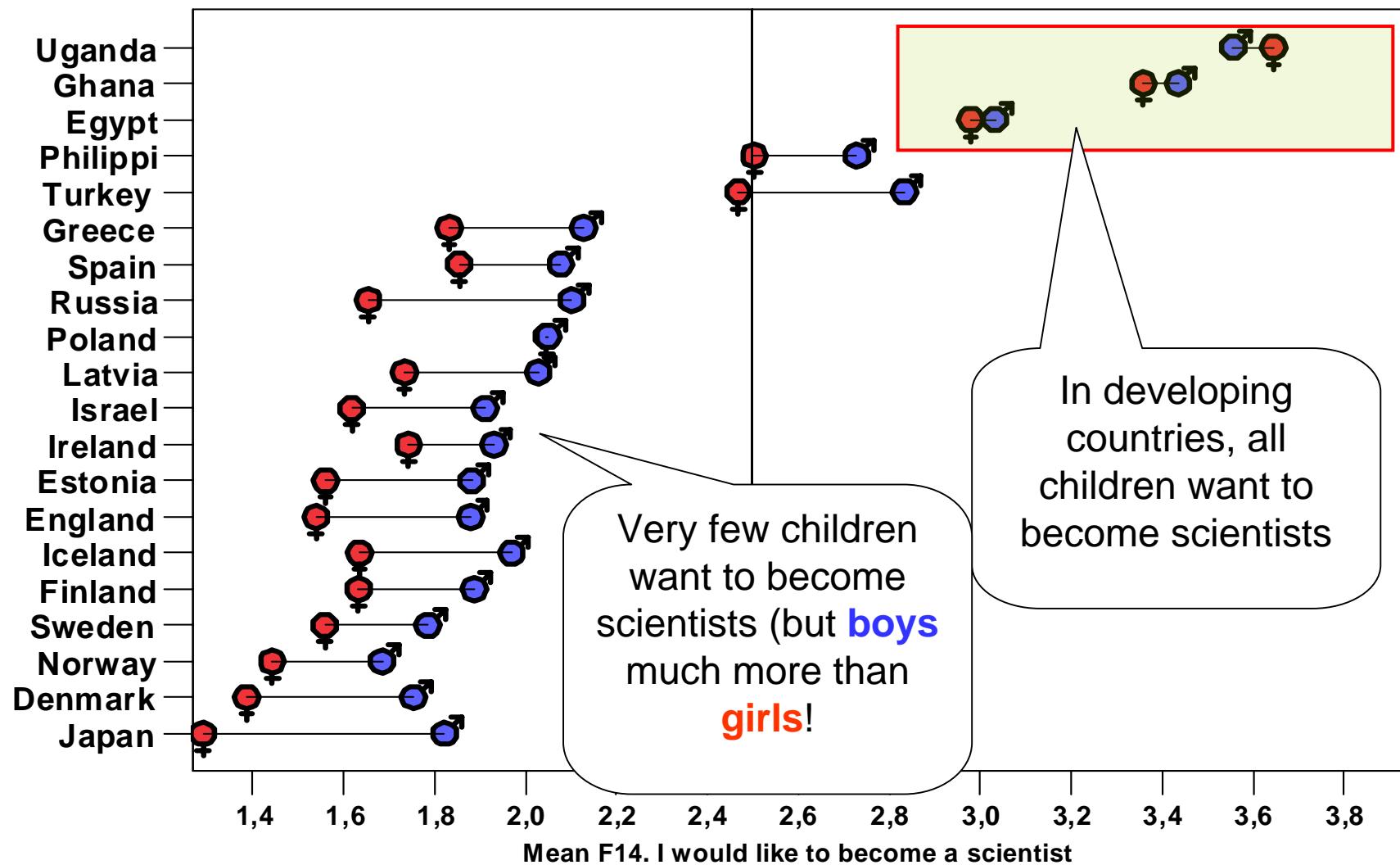
Important for future job: "Working with people rather than things"



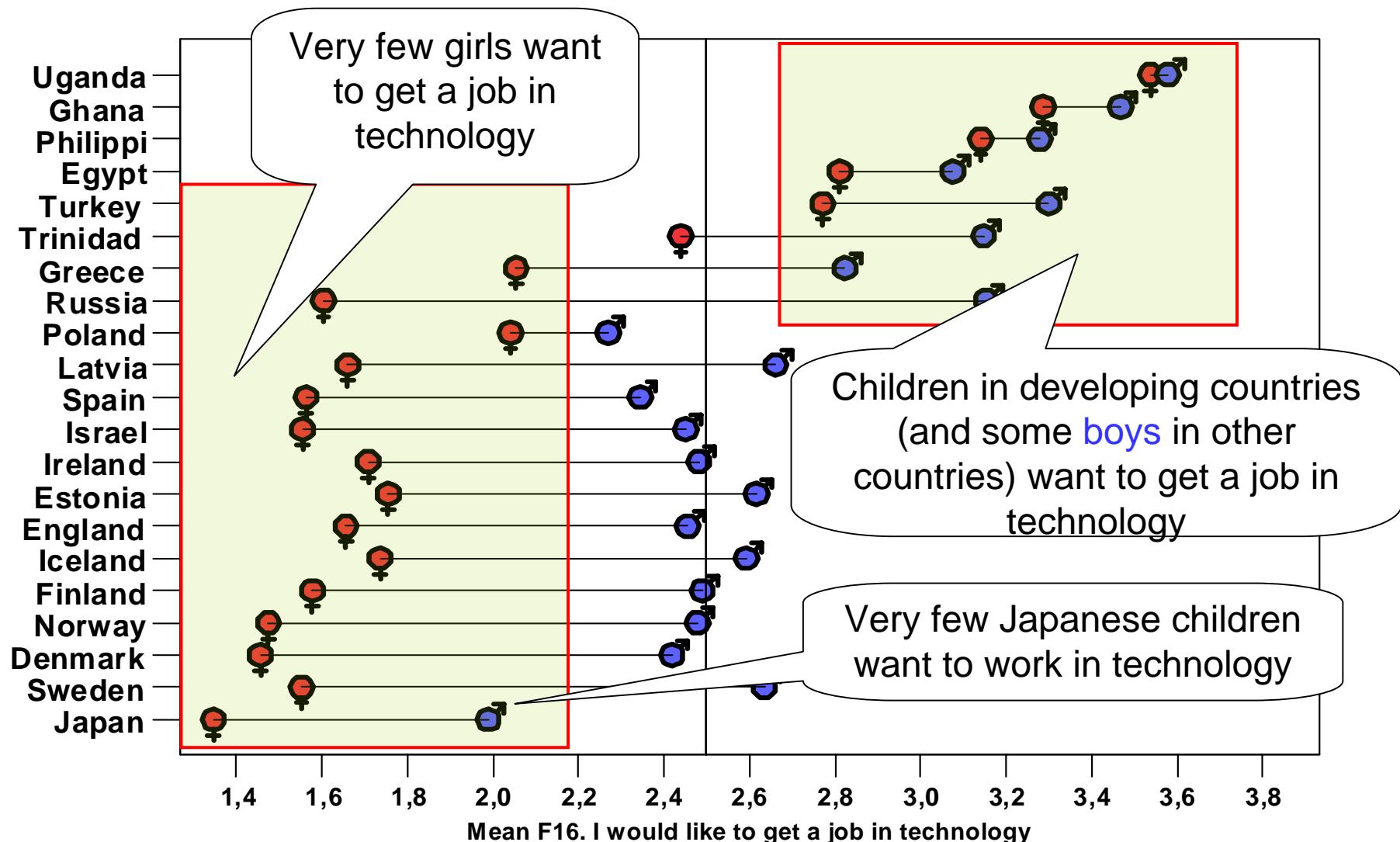
Important for future job: "Working with machines or tools"



”I would like to become a scientist”



I would like to get a job in technology”



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Science Education – from crisis to measures?

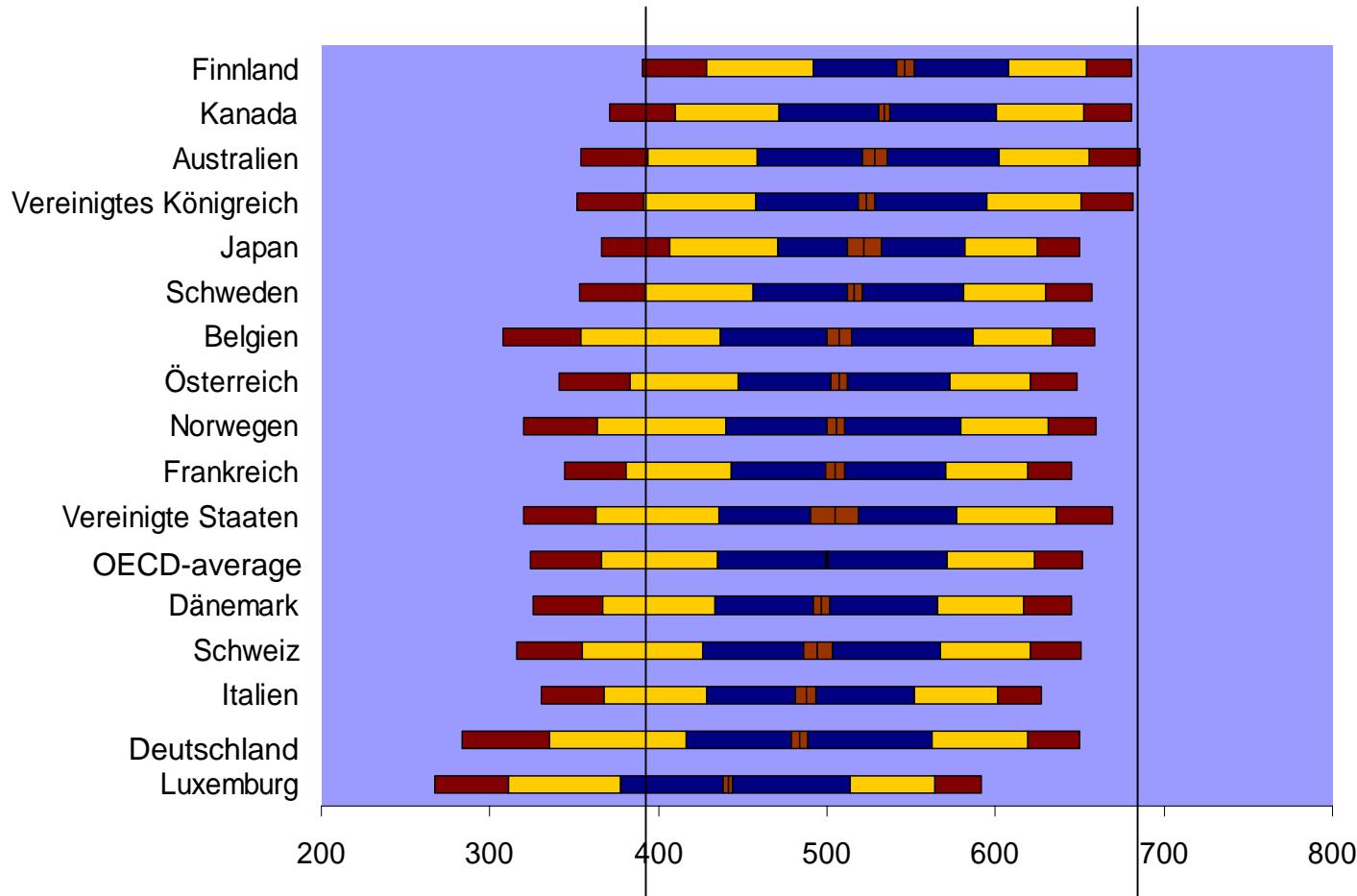
Where to start?

- What can we learn from PISA and other studies?
- Where do curriculum innovation set the focus?
- Will networks between schools and other learning opportunities be a way?
- Do not forget the teachers ...

What can we learn from PISA?

- Benchmarks: What is possible?
- High mean performance as well as a good background for all
- Causal relationships are complex
- ...

What can we get?



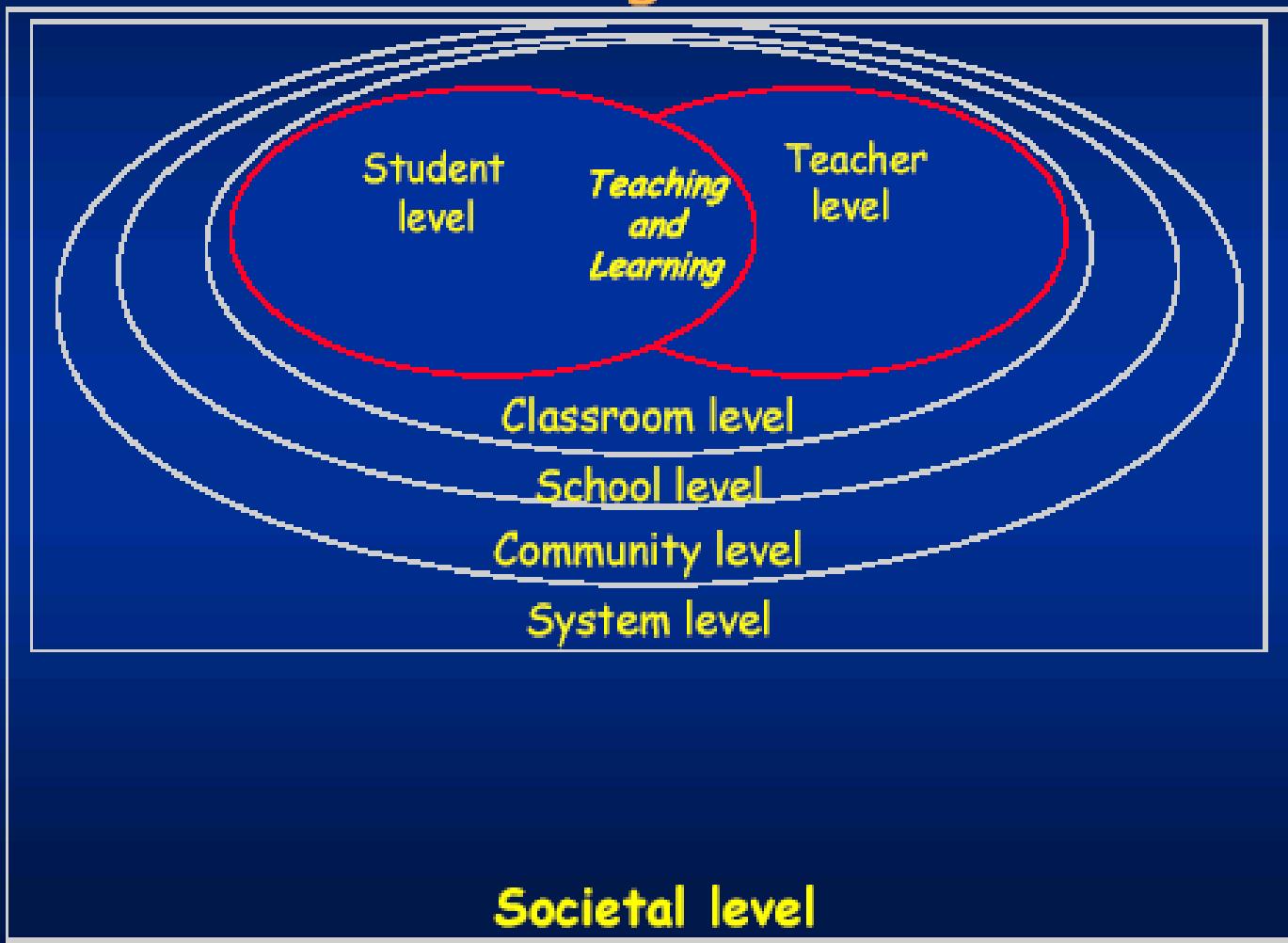
⇒ Excellence and understanding for many is possible!

Reasons are complex

„There is a serious risk that correlations between educational outcomes and properties of the system will be interpreted as direct causal relationships.“

⇒ **Performance of a school system is dependent on networks of interacting conditions!**

Figure 1: Teaching and Learning Framework



(Baumert et al., 2002)

Curriculum Innovations?

- Scientific literacy as a „silver bullet“?
 - No, but as a chance to integrate science for future scientists *and* science for all:
 - understanding scientific questions
 - drawing evidence based conclusions
 - using scientific knowledge for decision making processes

⇒ **Science knowledge and general education through science!**

Education through science

Student conceptions



Social sciences

Natural sciences and technology

Career perspectives



Personal relevance

⇒ Scientific literacy!

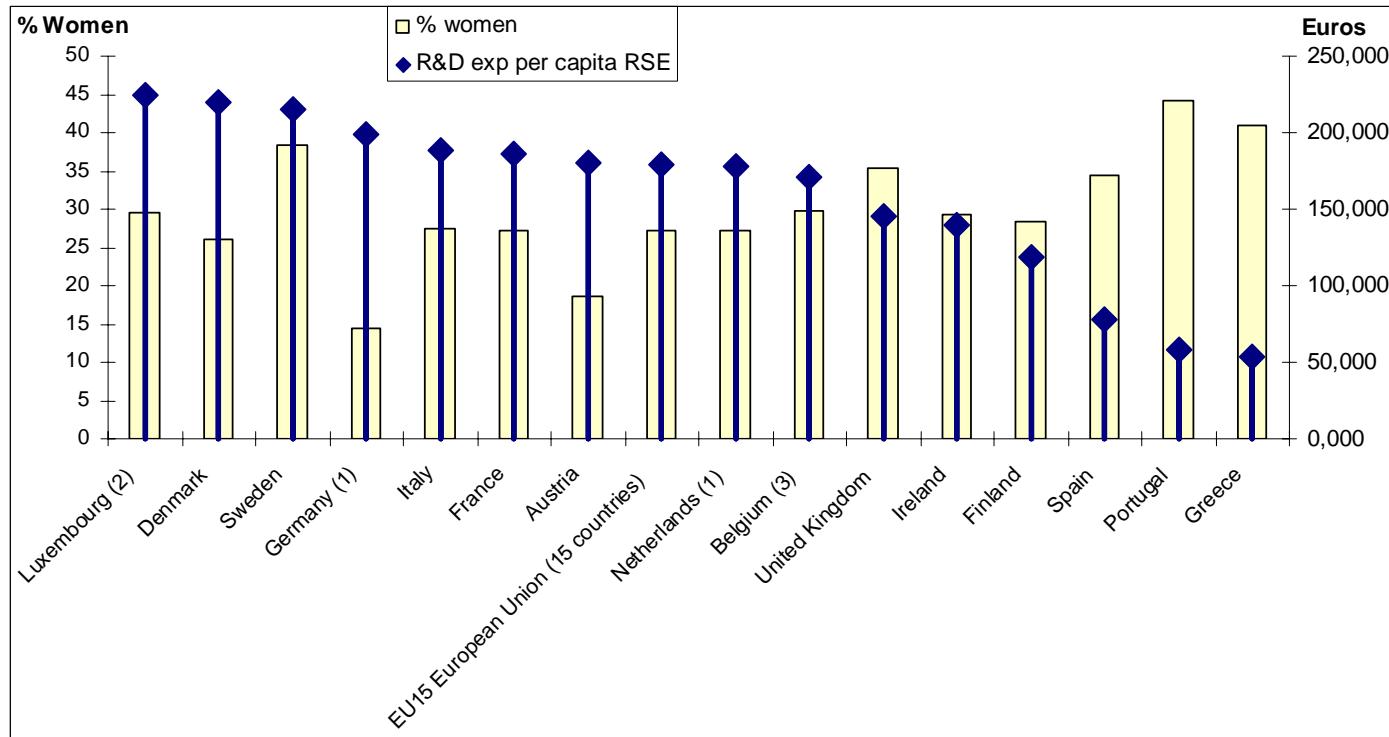
Competent through science

- The fairy tale of „scientific giftedness“ ...
- What can everybody learn also from science?
 - rational argumentation
 - practical skills
 - the language of science
 - judgement and decision making
 - co-operative working

⇒ **intellectual, communicative, personal, social, ...**

Science for all – what about gender issues?

Figure 1: Percentages of women among researchers and R&D expenditure per capita researcher in Euro, 2001



⇒ **Gender balances? -**
more than an issue of education and expenditure!

Networks?

- Science centres, research laboratories, university initiatives: **authentic insight** into research and careers
- also a **stimulus** for school science and career perspectives?



Science from the very beginning!

Do not forget the teachers!

- Recruitment of well-trained teachers
- Professional development as a continuous process:
 - networks between practitioners and researchers („learning communities, communities of practice“)
 - teacher associations 
 - goal orientation (standards?) and flexibility



⇒ **Inservice training and inservice learning!**

⇒ Coherent measures and
long-term perspectives
instead of bits and pieces?

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